Institute for Materials Science – Rapid Response Recipient Seminar

Title: Optimizing Image Segmentation for Quantitative Studies of Materials [*]

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Date: Tuesday, March 29, 2016
Time: 11am – 12pm
Location: IMS/MPA Conference Room, TA-3, Bldg 32, Rm 134

Abstract: Recent advances in materials characterization techniques have opened the door for the collection of imagery during metal alloy processing at unprecedented rates. This imagery contains a huge amount of information about microstructural characteristics and their evolution at various length scales, but only a small fraction of the collected data ever ends up subject to expert scrutiny.

We present variational image segmentation approach that facilitates the analysis of metal alloy solidification data collected by in-situ x-ray and proton radiography. We focus on image segmentation, i.e. partitioning of image into constituent regions that correspond to microscopic structures of interest that are quantitatively characterized. The quality of the image segmentation determines how well microstructural characteristics of interests can be detected and quantified. In contrast to conventional methods of image segmentation (e.g., edge-based and thresholding-based segmentation), variational segmentation, particularly active contours, exhibits high noise tolerance and the capability of detecting objects in spite of their noisy appearance. This is due to posing the segmentation as an optimization of a given energy functional, which takes into account both geometry and spectral image characteristics at local and global spatial scales, and temporal gradient, if temporal data component is available (e.g., video). The basic idea is to have the contours driven by image spectral discontinuities as well as image regions' properties. The contours are represented implicitly as the zero level set of a higher dimensional level set function. Optimization of the energy functional drives the contours to segment the image into partitions with homogeneous properties and is achieved by tracking the zero level set. We show examples of the active contours approach application to processing of metal alloy solidification imagery.

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Bio: Alexei Skurikhin is a research scientist in ISR-3: Space Data Science and Systems Group in the Intelligence and Space Research Division. His PhD was obtained in 1996 from the Institute of Biophysics of Russian Academy of Science, Pushchino, Russia. He came to Los Alamos in 1997. His research interests include probabilistic graphical modeling, machine learning, remote sensing applications, and image analysis.

Hosted by Alexander Balatsky * Director of the Institute for Materials Science